

Accepted Manuscript

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PII: S1385-8947(17)30127-4
DOI: <http://dx.doi.org/10.1016/j.cej.2017.01.113>
Reference: CEJ 16415

To appear in: *Chemical Engineering Journal*

Received Date: 4 July 2016
Revised Date: 17 December 2016
Accepted Date: 27 January 2017

Please cite this article as: S. Voltolina, P. Marín, F.V. Díez, S. Ordóñez, Open-cell foams as beds in multiphase reactors: residence time distribution and mass transfer, *Chemical Engineering Journal* (2017), doi: <http://dx.doi.org/10.1016/j.cej.2017.01.113>

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Open-cell foams as beds in multiphase reactors: residence time distribution and mass transfer

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Abstract

The hydrodynamic properties (residence time distribution and holdup), gas-liquid surfaced area and mass transfer coefficients for two foamed fixed beds are measured and compared with correlations proposed in the literature. Two foam materials, an Al₂O₃ foam of 20 ppi and a β-SiC foam of 7 ppi, were considered and experiments were performed in the trickle regime varying liquid and gas superficial velocities, in the ranges 0.001-0.005 m/s and 0.045-0.079 m/s, respectively.

Residence time distributions were measured by the stimulus-response method using a pulse tracer. This technique provides information about the liquid hold-up and the flow pattern, including the degree of mixing. The deviations from ideal plug flow have been modelled using the dispersion model.

The gas-liquid mass transfer and effective surface area have been studied using the method of Danckwerts, based on the reaction between CO₂ and NaOH.

Keywords: reticulated structures; phase contact; trickle regime; hold-up; dispersion model; effective surface area.

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